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A low-carbon roadmap for the Egyptian cement industry

Up until 2014, the Egyptian cement industry principally used state-subsidised natural gas and heavy fuel oil to fire their kilns. Due to the gradual phasing out of the subsidies, using natural gas and heavy fuel is no longer economically viable.

The enactment of amendments to the environmental law in April 2015 now allows Egyptian cement companies to use coal and petcoke. Such fuel switch will, however, *increase* CO_2 emissions. Therefore this new regulation requires that the operating permit of companies using solid fuels should include a plan of action on how they will limit the increase of CO_2 emissions.

The technologies that can reduce CO_2 emissions in the cement industry are well known, but their deployment will not necessarily happen simply because of an amendment to a law. Mitigation actions such as using alternative fuels (AF), energy efficiency improvement, clinker content reduction and by-pass dust (BPD) recycling must be technically and economically attractive to be implemented. This will require supporting policies and decisive and collaborative action by several stakeholders, including authorities and cement producers, as well as upstream and downstream companies.

Recognising the need to objectively assess the possibilities and necessary actions, a *'Low-Carbon Roadmap for the Egyptian Cement Industry'* was developed in 2016 by South Pole Group and Cementis in Zürich, for the European Bank for Reconstruction and Development (EBRD), the Egyptian Environmental Affairs Agency, the Chamber of Building Materials Industries / Cement Industry Division and in collaboration with the Ministry of Trade and Industry and the Cement Sustainability Initiative.

Key findings

Industry performance: Although the clinker kilns in Egypt are of the Best Available Technology (BAT), their operational performance indicators compare unfavourably with Best Available Practice (BAP) and industry in most other world regions:

- Due to the high chlorine content of Egyptian limestone deposits, as much as 5% of clinker volume is discarded and landfilled as by-pass and cement kiln dust, resulting in energy losses and CO_2 emissions;
- Whereas about half of the Egyptian clinker kilns operate close to BAT thermal energy efficiency (taking into account dust disposal), the others consume on average about 14% too much energy;
- In Egypt, waste and biomass derived fuels contribute less than 5% to thermal energy, compared to 16% global average and 40% good available practice;
- The 89% clinker content in cement is 15% more than the global average and by far the highest worldwide;
- Electric power consumption is slightly above the global average, but 15% above BAT.

Right: Qatamia Cement plant, now part of HeidelbergCement. **Source:** Italcementi website.

Left: Bagged cement awaiting dispatch from Arabian Cement Company. **Source:** Arabian Cement Company website.

1. Lowering the clinker content in cement;
2. Increasing the use of AF;
3. Energy efficiency improvements;
4. Increasing the capacity utilisation of kilns.

The switch from natural gas and fuel oil to solid fuels will increase CO_2 emissions by 15%, from 710kg of CO_2 per tonne of cement on average in 2013 to 820kg of CO_2 per tonne of cement and to around 76Mt of CO_2 in total in 2030. Consequently, the Egyptian cement production will be within the highest 2% globally by CO_2 intensity.

Furthermore, the Egyptian cement sector's economic performance and competitiveness are not ideal. For the last five years the Egyptian cement industry has operated at only about 70% capacity utilisation. Such low capacity utilisation is economically unsustainable in the long term and hampers the affordability of CO_2 mitigation measures. In particular, installed clinker production capacity is expected to be significantly higher than market demand for several years in the future.

Potential for emission reduction and energy performance improvement

The new coal regulation and the Low-Carbon Roadmap seek to set the pathway for the Egyptian cement industry to reduce its CO_2 emissions, so that the 15% CO_2 emission increase resulting from the fuel switch can be compensated. Although several options for CO_2 mitigation exist, achieving the objective could become technically feasible in Egypt through mainly four levers:

"The switch from natural gas and fuel oil to solid fuels will increase CO_2 emissions by 15%..."

Key policy actions in the next 5-10 years

For the cement companies to effectively implement the mitigation actions suggested in the Low-Carbon Roadmap and improve their energy and CO_2 performance, these actions must be economically attractive.

This is, however, currently not the case in the present economic and policy context in Egypt. Hence decisive action by several governmental, public and business stakeholders is indispensable for creating the necessary conditions for improvement. The Roadmap describes the necessary policy actions, some of which can be summarised as follows:

Good data: Good data is key for good decision-making. A cement sector monitoring, reporting and verification (MRV) system and database, compatible with the CSI international standard, should be

Left: The efficient processing of wastes into alternative fuels will be important for the Egyptian cement sector.

installed, collecting reliable information on all key performance indicators defining the industry's CO_2 emissions;

Slow down capacity addition: The pace of licensing new clinker and cement installations should be adapted with the purpose of balancing installed production capacity with long-term domestic cement market demand and taking into account a lower content of clinker in cement. No additional new clinker capacity needs to be built before 2025. Until 2020, increasing market demand can be met by increasing existing capacity utilisation and, until 2025, by lowering the clinker content in cement;

Change standards: Egyptian standards currently prohibit using most composite cements for reinforced concrete applications because of insufficient quality control and assurance at the construction sites. For the same reason Egyptian construction standards require heavier design specifications to ensure structural integrity.

Training of architects and engineers should be improved. A quality assurance certification system for ready-mix concrete installations and construction companies should be developed that would enable them to use composite cement and leaner construction while ensuring the structural integrity of the buildings. Coal fly ash, currently classified as hazardous waste, should be declassified and import of fly ash, slag and pozzolana for clinker substitution authorised.

Polluter pays: The key success factor for waste-to-energy and alternative fuels is market demand for environmentally sound waste disposal.

It is essential that waste producers have a legal obligation to dispose of their waste in a safe, environmental and legal way and ensure that their waste disposal complies with the 'waste hierarchy' and the 'polluter pays principle.'

While this currently does not exist yet in Egypt, adequate waste management legislation, regulation and law enforcement should be developed to generate market demand for environmental and legal waste treatment. This will lead to the development of proper waste management infrastructure and a market price for waste treatment and disposal. This will help to create a business case for waste-derived alternative fuels in the cement industry.

Using more BPD: While discarding BPD from the kiln cannot be avoided, techniques to recycle it do exist. If the applicability and costs of these techniques could be improved, by lowering their water and energy consumption and recycling the recovered salts, then significant further CO_2 savings could become possible.

Steering Committee for the Roadmap's implementation

The implementation of the policy and technology recommendations described in the Roadmap will enable, by 2030, a complete reversal in the projected CO_2 emission increase from the fuel switch. By 2030, 2.2Mt of coal will no longer have to be imported. A more ambitious scenario would further decrease specific CO_2 emissions to about 2% below the historic level prior to the fuel switch. The Roadmap is ambitious but realistically achievable in the Egyptian context.

A Steering Committee, chaired by the Ministry of Trade and Industry and supported by the EBRD and consultants from South Pole Group and Cementis, has been installed in 2017. It will bring together on a regular basis all stakeholders that are necessary to bring the Low-Carbon Roadmap into action and to improve the CO_2 emission and profitability of the Egyptian cement industry.

Right: The future of the Egyptian cement sector will be explored at the *22nd Arab-International Cement Conference* in Sharm El Sheikh, Egypt on 14-16 November 2017, along with the cement industries of other Middle Eastern and North African countries.